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NEVADA COOPERATIVE SNOW SURVEYS



Part II. Humboldt River Basin,
Eastern and Southern Nevada,
National Wildlife Refuges

Final Seasonal Snow Survey and Kindred Data,
April 1, 1943

Issued in cooperation with the Nevada Agricultural Experiment Station, United States Division of Irrigation of the Soil Conservation Service, Forest Service, Bureau of Reclamation, Weather Bureau, Geological Survey, Fish and Wildlife Service, Humboldt River Water Users, Nevada State Engineer, Elko-Lamoille Power Company, and Wells Power Company.

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HUMBOLDT RIVER BASIN

CENTRAL AND SOUTHERN NEVADA, AND WILDLIFE REFUGES

Plans and Progress

Plans rather than progress have attended the routine work of snow surveying and reports rather than forecasts have resulted from the accumulation of weather influences.

In snow-surveying, the possibility of snow-slides in late March in the pass leading into Marys River Basin and preventing access to the snow course there has caused the laying out of an alternate snow course in 76 Creek^{Basin}/adjoining Marys River Basin on the west. A cabin will be erected in Bear Creek Basin to complete the chain of shelters leading southward into this area from Jarbidge.

In the Salmon Falls Basin, adjoining Marys River Basin on the east, a series of snow courses reached from Pole Creek via Jarbidge or Contact would provide a complete index of snow-cover in north-eastern Nevada for both the Humboldt and Snake River tributaries.

Across the floor of the upper Humboldt Basin a series of low-level snow courses should be maintained to determine the character of the low snow that may affect particularly the early runoff and cause floods. Precipitation measurements alone are insufficient.

To assure rescue in case of accident, on overnight trips snow-survey parties should consist of at least three members, and the more remote shelter cabins should be supplied with toboggans and web snowshoes for transport. A two-way radio also should be installed. The Humboldt National Forest is leading in these precautions.

Stream gaging has been suffering not only from lack of observers but also from floods that have carried out staff gages and recorders. on North Fork, Susie and Mary Creeks, and on the Little Humboldt River and Martin Creek. The cable at Moleen Canyon on the main Humboldt was undermined.

Because of the varying fluctuation of the streams in the mountains continuous recorders must replace staff gages on the feeders of the Humboldt and because of difficulty of access weight-driven instruments with capacity of at least a month should be installed.

Furthermore, to avoid split channels at the outlet of the tributaries and assure a record during the period of winter freezing, stream measurements should be made of the main Humboldt below each large feeder or set of smaller ones.

The light cables used in metering the streams must be replaced by heavier wire and more enduring anchorage.

Marys River Basin, an excellent provider of snow, still awaits the installation of a recorder above diversions before definite forecasts of runoff can be attempted or the effect of obstructions in the channel can be determined.

In Lamoille Basin the recorder should be protected against surging by laying a concrete apron in the bed of the stream.

In Charleston Mountain area of Southern Nevada, the snow surveys should be extended to the west to serve Pahrump Valley and automatic recorders for temperature and precipitation should be installed at Charleston Ranger Station to assure continuous records throughout the winter and spring when the station usually is closed. The Las Vegas and Boulder City stations are too low to provide records comparable to those at Charleston Mountain.

The Legislature has restored the appropriation for snow surveying to \$1,500 a biennium. This and more will be necessary because of the increase in the size of snow survey parties, the additional snow surveys desired, and the necessity of closer observation of streams during runoff. Fortunately some cooperative funds have been provided by others.

The cooperative fund for stream measurements has been increased to \$3,000 for the biennium. The Division of Irrigation of the U. S. Soil Conservation Service has provided several stream-flow recorders. More stations and longer period recorders are necessary. The initial cost is necessarily high. A start in replacement and expansion can now be made.

I. HUMBOLDT BASIN

Unusual opportunity for observing the effect of rising water table on increasing the flow of the Humboldt has been afforded for a second year, while abnormal snow melt, winter rains, and above-normal summer rains are accumulating data of future use in forecasting abnormalities in the seasonal flow.

Three Unusual Years: 1940-41, 1941-42, 1942-43.

Although in the Sierra Nevada the runoff usually corresponds closely with the water content of the snow cover, other factors than the snow cover, materially affect the flow of the Humboldt. For example, in 1940-41 double normal precipitation throughout April-June, which was most effective on the snow, produced an excess of 121,500 acre-feet or 48.6 percent of normal above the 150,000 acre feet forecasted.

In the water year of 1941-42 the building up of a high water-table by double normal rains that continued into the winter and the sudden melting of low-level snow accumulated during the winter season increased the March-July flow from 193,280 acre feet indicated by the snow cover to 493,860 acre feet or an excess of 139.8 percent of normal.

The extremely high water table of the present season of 1942-43 has already raised the streamflow (May 15) to 137 percent of the March-July normal although the snow cover March 1 was only 91.4 percent of its normal. The effect of the excessive winter precipitation of 137.6 percent, of which 46 percent of normal was rain or melting snow, is still uncertain.

Tabular Comparison

Year	Snow Cover (Percent of Mar. 1 normal)	Actual Runoff (Percent of Mar.-July)	Divergence (Percent of normal)
1940-41	71.4	106.2	34.8
1941-42	89.8	229.7	139.9
1942-43	91.4	137.0 (to May 15)*	45.6 to May 15

* If the balance of the runoff should maintain the percentage of the snow cover, the final percentage runoff will be 179.5.

Forecast 1943

The radio forecast for the upper Humboldt made April 10 will still hold except that the maximum runoff may be considerably above 150 percent of normal.

This forecast was as follows:

Precipitation Nov-Feb..... 137.6 percent of
normal

Snow Cover March 1..... 91.5 percent of
normal

but at low levels only 42.1 percent of normal.

Water table highest of record.

Runoff at Palisade will be fully 150 percent of Mar-July new normal of 215,000 acre feet.

Since the high water-table affects the broad alluvial basins rather than the mountain canyons, this maximum must be applied mainly to the Humboldt at Palisade and the valley areas of the tributaries.

In the lower Humboldt, conditions have varied from high floods, heavy snow cover, and excessive precipitation in the Little Humboldt-Quinn River area on the north to normal precipitation in the Reese River area on the south. The reservoirs at the foot of the Humboldt have been overfilled and are being drawn down for safety.

FORECAST SUMMARY

Basins	Snow Cover March 1 Percent of Normal	Percentage Effect of Water-Table (Basis of 1942)	Normal Runoff Mar-July Acre feet	Probable Flow Percent of Normal	Acre feet Normal	Possible Maximum Flow Percent of Normal
Humboldt River at Palisade	High-level 91.4) Low-level 42.2)	66.8 116.0	215,000 (new)	185	397,750	200 430,000
Northern Feeders	High-level 104.9) Low-level 57.5)	" 73.3		189		200
Lamoille Creek at Power House	97.9	"	22,800 (old)	214	48,800	214 48,800
South Fork at Boltons	70.1	"	35,000 (old)	186	65,100	186 65,100
Martin Creek near Paradise	122.1		20,320 (new)	125	25,400	175 35,600
Quinn River	122.1			125		175
Reese River	91.3			100		

REVIEW OF THE 1942 FORECASTS

The following table gives the final results as compiled from data furnished by the U. S. Geological Survey and obtained by the Hydrographer for the Humboldt River employed by the State Engineer's office:

	Normal Flow acre feet	Forecasted Flow acre feet	percent of normal	Actual Flow acre feet	Diver- gence in Percent of normal
Humboldt River at Palisade (March- July period)	250,000 (old normal)	350,000	140	493,860	+57.5
Lamoille Creek at Power House (April-July period)	22,800	20,500	90	33,740	+58.0
South Fork, Humboldt River at Bolton Ranch (April- July period)	35,000	31,500	90	63,570	+91.6
Martin Creek, Little Humboldt Basin, at U.S. Gaging Station (March-July period)	14,300 (old normal)	20,000	140	19,875	-1.0

In the case of the lower watersheds of the main Humboldt and the Little Humboldt Rivers, the percentage of the snow cover was increased by 50 percent to include the probable effect of the April flood due to suddenly increased temperature and the high water table. This correction was plainly insufficient for the main Humboldt that was still 57.5 percent in excess even by the old and larger normal but would have been practically 90 percent by the new.

Martin Creek, on the other hand, if measured by the old normal, flowed exactly the additional 50 percent forecasted but by the new normal of 20,320 acre feet would have flowed little more than the percentage of the snow cover itself.

Lamoille Creek and South Fork are likewise confusing and even divergent from each other though flowing from a common crest. Inaccuracy in normals may be the cause.

Effect of Spring Flood and High Water-Table

To obtain a closer comparison recourse has been had to the monthly percentage of the April-July flow for 1942 alone. Stations representing high-as well as low-level runoff have been selected to isolate so far as possible the effect of the spring flood of April. The resulting table, which follows, seems definite:

Monthly Percentage of Total April-July Flow

<u>1942</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>April - July</u> <u>Percent</u>	<u>Acres Feet</u>
Marys River at Cabin Field (Low-level)	47	30	20	3*	100	58,000 ⁺
(Lamoille Creek at Power House (High-level)	7	19	53	21	100	33,740
(Lamoille Creek at McIntyres (Low-level)	24	24	36	16	100	53,620
(South Fork at Boltons (High-level)	10	23	50	17	100	63,570
(South Fork at Bullion (Low-level)	27	28	35	10	100	139,970
(Humboldt River at Palisade (Low-level)	36	25	30	9	100	431,340
(Humboldt River at Palisade Normal (Low- level)	26	30	33	11	100	182,400
Martin Creek (Low-level)	39	34	23	4	100	19,880

*Estimated

On Lamoille Creek and South Fork the relative April flood flow was three times greater below 6,000 feet altitude than above and apparently even more on the Marys and Little Humboldt Rivers.

The isolation of the two factors of flood melting and high water-table is made easy by the natural fluctuation of the former and the steadiness of the latter. For example, in the following comparison of the runoff of the Humboldt at Palisade for 1942 and its normal, with the single exception of April when the flood occurred, close uniformity between seasonal runoff and normal prevails throughout the season despite the quantitative difference between them.

Percentage Comparison of 1942 and Normal Runoff of Humboldt*

	Mar.	Apr.	May	June	July		Total
Humboldt 1942	13	32	22	26	7	100	493,860 A.F.
" Normal	15	22	26	28	9	100	215,000 A.F.

The quantitative flood effect is therefore the 10 percent divergence in April or on the basis of the total 1942 flow of 493,860 acre feet 49,386 acre feet. This harmonizes with excess accumulation of 50,000 acre feet during March, 1913-14 due apparently to high temperature (2.00°F above normal).

The water-table effect on the basis of the excess above 90 percent of normal represented by the snow and corrected for flood in April is as follows:

March	33,180	acre	feet
April	66,234	"	"
May	58,650	"	"
June	74,040	"	"
July	18,870	"	"
Total	250,974	"	"

The gain apportioned to the two factors is thus (1) spring flood 50,000 acre feet and (2) high water table 250,000 acre feet. In view of the area of probably 6,000,000 acres contributing to the stream flow of the upper Humboldt, this excess of 250,000 acre feet would be only 1/2 inch if spread over the entire area.

*In the following table by H. P. Boardman the close harmony of the four months March-May, June and July is shown by omitting April from the group.

Then by showing April alone the great difference in percent of normal is shown.

Month	Normals		Actual 1942			
	Acre feet	%	%	Acre feet	% of Normal	
March	32,600	19	19	62,500	192	
May	54,500	33	32	107,700	197	
June	60,400	36	38	128,400	213	
July	20,300	12	11	37,140	183	
Totals	167,800	100	100	335,740	200	
April	47,200			158,100	335	

The factor of temperature, other than in April, was dormant or regressive as shown by the monthly temperature departure at Elko and Lamoille:

	<u>Temperature Departure from Normal</u>				
	March	April	^{OF} May	June	July
Elko	-4.6	-1.7*	-5.8	-5.1	+0.9
Lamoille	-3.4	-0.9*	-3.1	-2.3	+2.6

*In early April the temperature as measured at Lamoille suddenly rose to 12.0°F above normal and continued at +6.0°F during the following two weeks, causing a runoff at Palisade for the month of 152,000 acre feet. The temperature departure at Elko during the first three weeks was +3.0°F and fell to -1.5°F for the month.

Precipitation was likewise without effect, being in moderate excess in April and May but deficient in March, June, and July. Thus the excess and deficiency were approximately in balance.

Precipitation Departure from Normal
In.

	March	April	May	June	July
Upper Humboldt					
Tuscarora	-1.37	+0.26	+0.02	-0.53	-0.53
Arthur	-1.06	-0.84	-0.12	-0.65	-0.73
Lamoille	-0.60	+0.82	+1.44	-0.52	-0.14
Hylton	-1.44	+0.80	+0.64	-0.58	-.58

Little Humboldt

Paradise Valley	-0.53	+0.34	-0.07	-0.19	-0.33
Orovada	-0.55	+0.64	+1.59	+0.46	-0.18

Runoff 1942
(Acre feet)

Marys River in Cabin Field (April-July).....	57,080	(thru July 8)
North Fork at U.S. Highway 40 (April-July).....		
Maggie Creek at U.S. 40 (April-July).....		
Susie Creek at U.S. 40 (April-July).....		
Marys Creek at Carlin.....		
Starr Creek in Lower Starr Valley (April-July)....		
Secret Creek above 71 Ranch (April-July).....		
Lamoille Creek at Power House (April-July).....	33,740	
Lamoille Creek at McIntyre's (April-July).....	53,620	
Rabbit Creek in Seitz Canyon (May-July).....		
South Fork at Bolton Ranch (April-July).....	63,570	
South Fork at Bullion (March-July).....	155,790	
Humboldt River in Moleen Canyon (April-July).....		
Humboldt at Palisade (March-July).....	493,860	
Humboldt at Callahan Station (March-July),.....	339,870	
Rye Patch Reservoir-Storage July 31.....	179,070	
Martin Creek (March-July).....	22,515	

NEW STREAM-FLOW NORMALS

Normal Runoff of Upper Humboldt at Palisade

New normal based on
37 yr. record 1903/04 - 1939/40 inclusive

By H. P. Boardman

(Acre feet)

<u>Winter (Nov.-Feb.)</u>		<u>Spring-Summer (March-July)</u>		<u>Late Summer- Autumn (Aug.-Oct)</u>
Nov.	4,600	March	32,600	Aug. 3,600
Dec.	5,400	April	47,200	Sept. 2,100
Jan.	6,600	May	54,500	Oct. 3,500
Feb.	12,200	June	60,400	
		July	20,300	
Total	28,800		215,000	9,200

Total Annual Runoff 253,000

Monthly and period normals are being computed for Lamoille Creek and South Fork on the upper Humboldt and at Callahan's Ranch above storage on the lower Humboldt.

For the Little Humboldt the following revision has been made:

Normal Runoff of Martin Creek

Based on comparison with Humboldt Runoff at Palisade
Percent of 37-year normals for years 1921/22 - 1939/40 (the
years available for Martin Creek)

By H. P. Boardman

(Acre feet)

<u>Winter (Nov.-Feb.)</u>		<u>Spring-Summer (March-July)</u>		<u>Late Summer- Autumn</u> (August-October)
Nov.	740	March	3,610	Aug. 620
Dec.	750	April	6,330	Sept. 500
Jan.	830	May	6,530	Oct. 700
Feb.	1,380	June	2,950	
		July	900	
Total	3,700	Total	20,320	Total 1,820
Dec.-Feb.	2,960	Apr.-July	16,710	
		Apr.-June	15,810	

Total Annual Runoff 25,840

FORECAST DATA FOR PRESENT SEASON

1942-43

Percent of Normal

I. Snow Cover

Snow Cover March 1	High-level	Low-level	Precip Nov-Feb.
North Feeders	104.9	57.5	152.3
Weighted, High L. 1 to Low L. 2	73.3		
South Feeders	78.0	26.7	122.9
Average		52.4	
Lamoille	97.9		145.6
<u>Upper Humboldt</u>	<u>91.4</u>	<u>42.2</u>	<u>137.6</u>
Average		66.8	

Little Humboldt-

Quinn River	122.1	187.4
Reese River.....		91.8

Snow Cover April 1

North Feeders	94.0	0	50.0
South Feeders	85.0	0	68.7
Lamoille	107.8		53.8
<u>Upper Humboldt</u>	<u>90.0</u>	<u>0</u>	<u>59.4</u>
Little Humboldt-			
Quinn River	113.5		53.9
Reese River.....			119.7

II. Water Table, March 1
(as shown by well measurements)

	Normal Level Feet below surface*	1943 Departure
Elko Valley	11.62	+1.65
Lamoille Valley	4.24	+0.84

*Elko normal based on 1938-43; Lamoille 1935-43.

On the basis of 1942, the present high water-table should produce an excess of 250,000 acre feet at Palisade above the runoff indicated by the snow cover percentage, or since the water-table is now still higher the excess could be even more.

In terms of the new normal of 215,000 acre feet, this excess would be 116 percent. Pending further comparison, this percentage will be applied to the smaller streams also--and to the monthly as well as the total seasonal flow.

III. Temperature during March
of

	Mean	Departure	Mean above Freezing	Departure
Upper Humboldt Elko	37.7	+0.1	17.0	+6.9
Little Humboldt- Quinn- Winnemucca	42.2	+2.2	18.0	+7.6
Reese River Austin	35.8	-0.3	14.6	+6.9

IV. Precipitation during March
Normal in. Percent of normal

Upper Humboldt		
North Feeders	1.42	50.0
South Feeders	1.82*	68.7
Lamoille	1.90	53.8
Little Humboldt- Quinn River	0.89	53.9
Reese River	1.52	119.7

* Weighted

V. Snow Cover Change in March

	Normal Key Courses only (1935-41) in. (Water Equiv. in.)	Key Courses in. (Water Equiv. in.)	1943 General Average	Percentage Snow Survey Mar. 1 High- Low- Level Level	
Upper Humboldt North Feeders	-0.01	-1.0	-2.5	-10.9	Ground bare
South Feeders	+1.7	+0.25	+0.5	+ 7.0	"
Lamoille	+1.7	+0.25	+0.25	+ 9.9	
Little Humboldt Quinn River			-1.3	- 8.6	
Reese River			-0.5		Ground bare

VI. Runoff during March
Acre feet

	Normal	1943	Percent of normal
Lamoille Creek at Power House			
South Fork near Bullion		10,900	
Humboldt at Palisade	32,600	111,000	340.5
Martin Creek above Paradise Valley	3,610	6,140	170.1



VII. Summary

The precipitation during 1942-43 has been complex. The total snow and rain combined during the winter has been for the upper Humboldt 137.6, Little Humboldt 187.4, and Reese River 91.8 percent of normal. The snow cover, however, even at the higher-levels has been only 91.4 percent for the upper Humboldt and 122.1 percent for Little Humboldt-Quinn River, and at the lower-levels as little as 42.2 percent on the upper Humboldt.

Since snow cover is far more efficient than rainfall in creating runoff, the seasonal percentage of the snow cover rather than that of the heavier precipitation should be chosen in making a forecast. Since, however, the snow cover in the lower and relatively larger areas is scant or lacking, the average of the two should be adopted, or 66.8 percent for the upper Humboldt. The effect of the precipitation will appear in that of the water-table built up at least in part from it.

On the basis of the excess flow of 250,000 acre feet in 1942 due evidently to the high water-table, a similar excess can be expected the present year, distributed proportionately as before throughout the runoff period even at high levels.

The above-normal shrinkage of the snow cover in March was doubtless due to acceleration of melting from unusually high density and deficiency of March precipitation.

During April the weather was warm and precipitation approximately normal. May has been both cold and deficient in moisture with consequent drying of the range. These factors will provide only minor corrections in the forecast when combined with the heavy correction for high water-table.

The residual snow on the Santa Rosa Range, the full length of the Ruby Mountains, and on the Jarbidge Range indicates a steady flow fully normal and probably much greater for the remainder of the March-July period.

APRIL 1 SNOW SURVEY DATA

1. UPPER HUMBOLDT BASIN

Temperature departure March, Elko (5,077 ft.) +0.1°F (Mean 37.7°F)

Mean temperature above freezing 17 of (Normal 10.1°F)

Elevation: feet	Date	Snow depth inches	Density percent	Water equi- valent	Normal water equi- valent Mar. 1	Percentage of Mar. 1 normal	Seasonal precip. and percentage of normal: at U.S.W.B. Stations: March
<u>Northern Feeders</u>							
<u>Marys River</u>							
Bear Creek	8,100				20.6		Jarbridge-Mala Vista
Fox Creek	6,900				11.1		(6,100-5,585 ft.)
Marys River	8,000				20.3		1.08 in.
<u>Marys River-North Fork</u>							
Big Bend	6,800	38.3	39.9	15.3	12.1	126.4	
Gold Creek R.S.	6,600	24.0	57.2	8.9	8.6	103.5	
<u>North Fork</u>							
Jack Creek	7,800	24.5	58.5	9.4	11.6	81.0	North Fork-Tusca-
Jack Creek	7,000	0	0	0	7.3		rora-Owyhee (6,500-
Rodeo Flat	7,000	26.2	40.4	10.6	14.3	74.1	5,400 ft.)
Fry Canyon	6,800	23.6	36.8	8.7	13.6	73.0	(Normal 1.42 in.)
Tremewan Ranch	5,600	0	0	0	4.0	64.0	50.0
<u>Susie-Maggie Creeks</u>							
Taylor Canyon	5,200	0	0	0	7.7		

AVERAGE OF NORTHERN FEEDERS

Higher Levels 94.0
Lower Levels 0

50.0

1. UPPER HUMBOLDT BASIN (Cont.)

[illegible]

+ Cross course

1. UPPER HUMBOLDT BASIN (Continued)

*The average for the Southern Feeders is computed by weighting the three groups of stations representing South Fork, Lamoille Creek, and Starr Creek on the basis of 2, 1, and 1/2 representing their relative contributions to the flow of the main Humboldt.

11. LOWER HUMBOLDT BASIN

Temperature departure March Winnemucca (4,287 ft.) +2.2° F (Mean 42.2° F.)

Mean temperature above freezing 18 °F (Normal 10.4 °F)

Elevation feet	Date	Snow depth inches	Density percent	Water equi- valent inches	Normal water equivalent March 1	Percentage of Mar. 1 normal	Seasonal precip. and percentage of normal at U. S. W. B. stations March:
<u>Rock Creek-Little Humboldt</u>							
Midas	7,000	Mar. 29	7	32.9	2.3		
Lamande Creek	7,000				12.6		Paradise Valley-Orovada
Granite Peak	8,600	Mar. 3	44.8	42.7	19.2	141.2	(4,650-4,300 ft.)
Martin Creek R. S.	7,000	Apr. 2	14.4	38.9	5.6	70.9	53.9 (Norm. 0.89 in.)
Upper Buckskin Mt.	8,200	Mar. 31	35.8	43.6	15.6	151.5	113.5
Lower Buckskin Mt.	6,800	Mar. 31	20.3	41.9	8.5	90.4	
AVERAGE LITTLE HUMBOLDT BASIN							
						113.5	53.9
<u>Reese River Basin</u>							
Temperature departure March, Austin (6,594 ft.) -0.3°F (Mean 35.8°F)							
Mean temperature above freezing 14.6°F (Normal 7.7°F)							
<u>Big Creek</u>							
Upper Big Creek	8,000	Mar. 31	16.3	38.1	6.2		Austin (6,594 ft.)
Cabin Course		Mar. 31	0	0	0		119.7 (Norm. 1.52 in.)
Big Creek Camp Ground		Mar. 31	0	0	0		
<u>Reese River</u>							
Upper Corral	8,500	Mar. 30	8.5	42.0	3.6		
Lower Corral	7,500	Mar. 30	0	0	0		

CHANGE IN SNOW COVER AT ALL STATIONS DURING MARCH

(Inches water)

1. UPPER HUMBOLDT BASIN

Temperature Departure Elko (5,077 ft.) +0.1°F (Mean 37.7°F); Mean temperature above freezing 17°F.
(normal 10.1°F)

Northern Feeders

	Marys River		Marys River-North Fork	
Bear Creek (8,100 ft.)	Fox Creek (6,800 ft.)	Marys River (8,000 ft.)	Big Bend (6,800 ft.)	Precipitation at Jarbidge-Mala Vista (6,100-5,385 ft.) Normal in.
March 1	22.5	9.6	24.0	16.3
April 1				15.3
Gain or loss				- 1.0
				10.9
				8.9
				- 2.0
				1.03

North Fork

	Jack Creek (7,800 ft.)	Jack Creek (7,000 ft.)	Rodeo Flat (7,000 ft.)	Fry Canyon (6,800 ft.)	Tremewan Ranch (5,600 ft.)	Precipitation at North Fork-Tuscarora-Wyhee (6,500-5,400 ft.) Normal 1.42 in.
March 1	12.3	3.3	12.5	10.7	2.3	
April 1	9.4	0	10.6	8.7	0	0.71
Gain or loss	- 2.9	- 3.3+	- 1.9	- 2.0	- 2.3+	

Susie-Maggie Creeks

Taylor Canyon
(5,200 ft.)

March 1	4.4
April 1	0
Gain or loss	- 4.4+
AVERAGE NORTHERN FEEDERS	Gain or loss in snow cover -2.5 in.; precip. 0.90 in.; temp. dep. +0.1°F (Mean above freezing 17°F)

CHANGE IN SNOW COVER AT ALL STATIONS DURING MARCH

(Inches water)

1. UPPER HUMBOLDT BASIN (Cont.)

Southern Feeders

Trout-Starr-Secret Creeks

	Trout Creek (8,500 ft.)	Trout Creek (6,900 ft.)	Dorsey Basin (8,100 ft.)	Dry Creek (6,500 ft.)	Ryan Ranch (5,775 ft.)	Precip. at Arthur-Wells (6,500- 5,633 ft.) Normal 1.66 in.
March 1	24.1	4.8	10.1	4.8	0.8	
April 1			17.9	0	0	0.79
Gain or loss			+ 7.8	- 4.8+	- 0.8+	

Lamoille-Rabbit Creeks

	Lamoille (9,000 ft.)	Lamoille (9,000 ft.)	Lamoille (8,500 ft.)	Lamoille (8,100 ft.)	Lamoille (7,600 ft.)	Lamoille (7,400 ft.)	Precip. at Lamoille-Elko (6,200-5,077 ft.) Normal 1.90 in.
March 1	31.6	29.1	21.0	13.7	12.0	11.7	
April 1	35.0	33.1	22.0	13.5	10.8	10.7	1.02
Gain or loss	+ 3.4	+ 7.0	+ 1.0	- 0.2	- 1.2	- 1.0	

South Fork-Ruby Lake

	Corral Canyon (8,500 ft.)	Green Mt. (8,000 ft.)	Harrison Pass (7,400 ft.) #2	Harrison Pass #1 (6,600 ft.)	Hagar Canyon (8,500 ft.)	Cave Creek (7,000 ft.)	Precip. at Hylton-Ruby Lake (7,081-6,200 ft.) Normal 1.85 in. (Hylton)
March 1	15.8	12.2	2.6	2.5+	19.1	14.6	
April 1	21.8	15.3	0	0	17.1	8.8	1.48
Gain or loss	+ 6.0	+ 3.1	- 2.6+	- 2.3+	- 2.0	- 5.8	

AVERAGE SOUTHERN FEEDERS Gain or loss in snow cover +0.5 in.; Precip. 1.25 in.; Temp departure +0.1°F (Mean above freezing 17.0°F)

Runoff from Upper Basin at Palisade during March 111,000 A.F. (Normal 32,600 A.F.)

CHANGE IN SNOW COVER AT ALL STATIONS DURING MARCH

(Inches water)

II. LOWER HUMBOLDT BASIN

Temperature Departure Winnemucca (4,287 ft.) +2.2°F (Mean 42.2°F)

Mean temperature above freezing 18 °F (Normal 10.4°F)

Rock Creek-Little Humboldt

March 1

April 1

Gain or Loss

Midas (7,000 ft.)

5.2

2.3

- 2.9

Little Humboldt Basin

Lamance Creek (7,000 ft.)	Granite Peak (8,600 ft.)	Martin Creek (R.S. 7,000 ft.)	Upper Buckskin (8,200 ft.)	Lower Buckskin (6,800 ft.)	Precip. at Paradise-Orovada (4,650-4,300 ft.) Normal 0.89 in.
13.6	18.9 19.2 + 0.3	9.5 5.6 - 3.9	14.9 15.6 + 0.7	9.3 8.5 - 0.8	0.48

March 1

April 1

AVERAGE LITTLE HUMBOLDT BASIN Gain or loss in snow cover -1.3 in.; precip. 0.48 in.; temp. dep. +2.2°F (Mean above freezing °F)

Reese River Basin

Temperature departure Austin (6,594 ft.) -0.3°F (Mean 35.8°F)

Mean temperature above freezing °F (Normal 7.7°F)

Upper Big Creek (8,000 ft.)	Big Creek Cabin	Big Creek Camp Ground	Reese River Upper Corral	Reese River Lower Corral	Precip. at Austin (6,594 ft.) Normal 1.52 in.
3.4 6.2 + 2.8	1.0 0 - 1.0+	T 0 0	5.4 3.6 - 1.8	2.7 0 - 2.7+	1.82

March 1

April 1

Gain or loss

AVERAGE REESE RIVER BASIN.

Gain or loss in snow cover -0.5 in.; precip. 1.82 in.;
temp. dep. -0.3°F (Mean above freezing 14.6°F)
No runoff records available.

Main Humboldt River

Precipitation stations only.

Precip. at Battle Mt.-
Winnemucca- Rye Patch
Dam-Lovelock (4,513-
3,977 ft.). Normal
0.65 in. (except Rye Patch)

Runoff Palisade 111,000 A.F. (Normal 32,600 A.F.)

Storage in Pitt-Taylor Reservoirs.....37,000 A. F.(Jan. 1)

Runoff Callahan Gaging Station near Inlay

Storage in Rye Patch Reservoir Apr. 1.....179,070 A.F. (attained Feb. 11)

Released previous to Apr. 1..... 81,200 A.F.

Since April 1, Pitt-Taylor Reservoirs have been drawn down to safeguard their embankments and flash boards have been erected on the gates of Rye Patch Dam to hold an additional 20,000 acre feet as a buffer in case of emergency.

Humboldt Sink is gradually becoming a lake again.

Northern Feeders

Southern Feeders

AVERAGE FOR PERIOD	Snow Cover		Precipitation (U.S.W.B.)	:	Snow Cover				Precipitation: (U.S. W. B.)	Mean Temperature		Snow Cover	Runoff at Palisade	
	Fox Creek (6,900 ft.)	Big Bend (6,800 ft.)	North Fork-Tuscarora-Owyhee (5,400-6,500 ft.)	:	Lamoille (7,400 ft.)	Lamoille (7,600 ft.)	Lamoille (8,100 ft.)	Lamoille (9,000 ft.)	Lamoille (6,100 ft.)	Elko (5,077 ft.)	April 1 (Percent of March 1 normal)	Percent of March Runoff (32,500 A.F.)*	Percent of March-July Runoff (215,000 A.F.)	
			Mar. normal 1.42 in.	:					Mar. (normal 2.83 in.)	Departure (Normal 37.6°F)	Mean Temp. above freezing (Normal 10.1°F)			
			Total	:					Total					
1935 - 1941	-0.2	-0.01	1.31	:	+0.8	+0.8	+1.5	+3.6	2.04	-0.79	-0.5	9.3		
1941				:										
March 1	7.6	9.9		:	10.2	9.4	11.2	22.7						
April 1	5.7	9.7		:	7.1	8.4	10.2	24.5						
Gain or loss	-1.9	-0.2	0.32	:	-3.1	-1.0	-1.0	+1.8	2.11	-0.72	+1.4	11.2	58.6	
1942				:										
March 1	9.8	10.2		:	12.4	12.7	13.3	23.8						
April 1	8.5	10.4		:	13.1	13.7	14.8	28.9						
Gain or loss	-1.3	+0.2	0.46	:	+0.7	+1.0	+1.5	+5.1	2.23	-0.60	2.7	7.0	83.9	
1943				:										
March 1	9.6	16.3		:	11.7	12.0	13.7	31.6						
April 1		15.3		:	10.7	10.8	13.5	35.0						
Gain or loss		-1.0	0.71	:	-1.0	-1.2	+0.2	+3.4	1.64	-1.19	+0.1	17.0	69.5	

*Relationship of March normal to March-July normal is 11.2 percent.

CHANGE IN SNOW COVER AT LOW LEVELS DURING MARCH

(Inches water)

1941-1943

Northern Feeders				Southern Feeders			
	Fry Canyon (6,800 ft.)	Gold Creek (6,600 ft.)	Tremewan Ranch (5,775 ft.)	Taylor Canyon (5,200 ft.):	Harrison Pass (6,600 ft.)	Dry Creek (3,500 ft.)	Ryan Ranch (5,775 ft.)
1941							
March 1	9.2	6.2	3.2	8.3	5.4	6.6	0.4
April 1	8.8	6.0		4.6	3.4	5.1	0
Gain or loss	-0.4	-0.2		-3.7	- 2.0	-3.5	-0.4
1942							
March 1	10.5	8.1	4.1	8.5	6.5	7.6	4.3
April 1	9.0	7.7	0.5	6.4	5.6	8.4	0.9
Gain or loss	- 1.5	-0.4	-3.6	-2.1	- 0.9	+ 0.8	- 3.4
1943							
March 1	10.7	10.9	2.3	4.4	2.3+	4.8	0.8
April 1	8.7	8.9	0	0	0	0	0
Gain or loss	- 2.0	- 2.0	-2.3+	-4.4+	-2.3+	- 4.8+	-0.8+

Average gain or loss in snow cover: 1941.....-1.7+ in.; 1942.....1.6 in.; 1943.....-2.7 in.

Normals or averages of snow on ground April 1 and loss of snow cover by melting during March will be computed as soon as sufficient data have been accumulated.



II. EASTERN NEVADA

The full complement of snow courses is now being surveyed but normals are not yet available.

In Steptoe Valley, the snow cover though heavier than in either 1941 or 1942 had completely disappeared at the snow course April 1. The precipitation during March was only one-half that of 1941 and 1942. The temperature at Ely was 4.3°F above normal.

In Baker Creek, the snow though less than in 1942 has lasted far better. The precipitation during March, however, was only half that of the previous year. The water equivalent of the snow is substantial.

EASTERN NEVADA

1943

APRIL 1 SNOW SURVEY DATA

Temperature Departure March, Ely (6,257 ft.) +4.30F (Mean 36.8°F)

Mean temp. above freezing 15.6°F

Mean temperature Lehman Caves Nat. Mon. (7,200 ft.) 49.4°F; above freezing 14.8°F
(Normals and departures not yet available)

Elevation feet	Date	Snow depth inches	Density percent	Water equivalent inches	Normal water equivalent inches	Percentage of Mar. 1 normal	Precipitation (U. S. W. B.) percentage March Ely (6,257 ft.)
Steptoe Valley							
Murray Summit	7,500:Apr. 1:	0	0				Lehman Caves Nat. Mon. (7,200 ft.)
Baker Creek							
Baker Creek #3	9,250:Apr. 1:	47.9	35.4	16.9			1.15 in.
Baker Creek #2	8,950:Apr. 1:	48.6	33.4	16.2			
Baker Creek #1	7,950:Apr. 1:	12.8	44.1	5.6			

CHANGE IN SNOW COVER DURING MARCH
(Inches of water)

Steptoe Valley Murray Summit (7,500 ft.)		Precipitation (U. S. W. B. Ely (6,257 ft.) Inches and percent- age of normal (Normal 1.19 in.)		Baker Creek Baker Creek No. 2 (8,950 ft.)		Baker Creek Baker Creek No. 1 (7,950 ft.)		Precipitation (U. S. W. B.) Lehman Cave Nat. Mon. (7,200 ft.) Inches and per- centage of nor- mal	
1941									
March 1	4.2								
April 1	0.7		0.93 in.;						
Gain or loss	- 3.5		78.2%						1.12 in.

1942									
March 1	3.7		1.03 in.;	21.3	15.6	5.3			
April 1	2.5		86.6%	17.6	17.6	2.9			2.42
Gain or loss	- 1.2			+ 2.0	- 2.4				

The snow cover in Steptoe Valley though slightly less on March 1 this year than last has lasted much longer into the season.

1943									
March 1	5.0			13.0	12.8	6.0			
April 1	0		0.44 in.;	16.9	16.2	5.6			1.15 in.
Gain or loss	- 5.0+		37.0%	+ 3.9	+ 3.4	- 0.4			

III. SOUTHERN NEVADA

The lower course in Kyle Canyon has been oun unsteady and has therefore been abandoned, and because of an emergency shift in rangers the higher courses in Kyle and Lee Canyons could not be found for the April survey.

While the snow cover is less than the abnormal cover of 1941, it is far above that of 1942, considered approximately normal. The apparently heavy shrinkage in March is due mainly to the late date of the April survey. The March precipitation at Las Vegas was 153.0 percent of normal.

SOUTHERN NEVADA

APRIL 1 SNOW SURVEY DATA

Temperature departure March, Las Vegas A. P. +4.7oF (Mean 53.5oF)

Mean temperature Charleston R.S. of

Elevation feet	Date	Snow depth inches	Density percent	Water equi- valent ins.	Normal water equi- valent ins.	Percentage of Mar. 1 normal	Precipitation (U.S.W.B.) percentage March
Charleston Mountain	:	:	:	:	:	:	:
Kyle Canyon 8,200	:	:	:	:	:	:	:
Kyle Canyon 7,400	:	:	:	:	:	:	:
Rainbow Canyon	:	:	:	:	:	:	:
7,800 :Apr. 13:	42.3	35.5	15.0	:	:	:	:
Lee Canyon 9,000	:	:	:	:	:	:	:
Lee Canyon 8,300 :Apr. 14:	23.6	31.0	7.3	:	:	:	Charleston R.S. Las Vegas Airport 153.0%

CHANGE IN SNOW COVER DURING MARCH

Charleston Mountain

Kyle Canyon : Kyle Canyon: Rainbow Canyon: Lee Canyon : Lee Canyon : Precipitation U. S. W. B.
(8,200 ft.) : (7,400 ft.): (7,800 ft.): (9,000 ft.): (8,300 ft.): Charleston R. S. (7,165 ft.)

1941	:	:	:	:	:	:	:
March 1	18.9	11.7	22.4	20.6	16.5	:	5.52
April 1	18.5	6.9	21.4	20.8	16.3	:	:
Gain or loss	- 0.4	- 4.8	- 1.0	+ 0.2	- 0.2	:	:

1942	:	:	:	:	:	:	:
March 1	8.8	5.4	10.5	9.9	7.8	:	1.86
April 1	9.5	4.0	11.0	15.2	11.3	:	:
Gain or loss	+0.7	- 1.4	+ 0.5	+ 5.3	+ 3.5	:	:

The snow cover this year is less than half of last but probably is normal.
Last year the precipitation was approximately 250 percent of normal.

1943	:	:	:	:	:	:	:
March 1	15.7	Abandoned	16.7	17.4	13.9	:	:
April 1*	:	:	15.0	:	7.3	:	:
Gain or loss	:	:	- 1.7	:	- 6.6	:	Las Vegas Airport 153.0%

*Apr. 13-14.

IV. WILDLIFE REFUGES

1. Sheldon Antelope Refuge

The snow courses are uneven. The Virgin water course seems to be even barer than last season but the March precipitation is better. The temperature is normal.

2. Ruby Lake Refuge

The snow cover is slightly less than in 1942 but shrank during March, though it increased in March 1942. The precipitation for the month seems to have been considerably better than at Arthur where it was only 11.6 percent of normal.

APRIL 1 SNOW SURVEY DATA

Sheldon National Antelope Refuge (Northern Washoo County)

[illegible]

GAIN OR LOSS OF SNOW COVER DURING
MARCH
(Inches of water)

	Sheldon Refuge Bald Mountain Creek (6,720 ft.)	Mahogany Mountain Virgin (5,680 ft.)	Precipitation (U. S. W. B.) Inches and per- centage of normal Sheldon (6,500 ft.)(Norm. 1.13 in.)	Hager Canyon (8,500 ft.)	Ruby Lake Refuge Cave Creek (7,000 ft.)	Precipitation (U.S. W. B.) Inches and percent of normal Ruby Lake
--	--	---	--	-----------------------------	---	--

1941
March 1 5.9
April 1 3.8
Gain or loss -2.1

14.8
15.6
+ 0.8

11.9 0.80 in.

1942

March 1 6.2
April 4.5
Gain or loss -1.7

21.0
23.5
+ 2.5

1.18 in.

At Sheldon Refuge snow conditions the present year are much the same as last except that Virgin watershed appears to be barer. At Ruby Lake Refuge the snow cover is 50 percent better than last.

1943

March 1 7.7
April 1 4.3
Gain or loss -3.4

19.1
17.1
-2.0

1.48 in.
Arthur 11.6%

PART I. CENTRAL SIERRA QUADRANGLE

Part I, embracing the eastern slope of the Central Sierra Quadrangle, is issued separately by the Forecast Committee of the Nevada Cooperative Snow Surveys and can be obtained upon request to the Chairman, Prof. H. P. Boardman, 735 West Street, Reno, Nevada.

Nevada Agricultural Experiment
Station
Reno, Nevada, May 20, 1943

J. E. Church

H. P. Boardman
Forecasters

R31Fsn

Snow and Water Storage
Nevada February 1, 1944

LIBRARY
CURRENT SERIAL RECORD

FEB 14 1944

U. S. DEPARTMENT OF AGRICULTURE

Of the usual 57 percent of normal seasonal snow provided annually in the Central Sierra by February 1 the snow cover this season is only 28 to 45 percent but the reservoir storage January 1 is reassuring.

The snow depth at Donner Summit is 50 inches.

In the upper Humboldt Basin the seasonal percentage of the snow cover is 43 percent and at Murray Summit in Steptoe Valley there are 12 inches of snow with water equivalent of 2.7 inches.

Storage is lacking on the upper Humboldt but on the lower Humboldt is abundant.

Details are included for study and reference:

Tahoe Basin and Vicinity

	Depth of Snow in.	Dens. %	Water Equiv. in.	Percentage of Normal Apr. 1
Donner Summit	50.1	27.7	13.9	29.1
Soda Springs	48.7	25.1	12.2	30.0
Ward Creek	41.9	34.8	14.6	28.5
Tahoe City	18.1	34.8	6.3	39.6
Marlette Lake	41.9	29.5	12.4	44.6
Sage Hen Creek	26.9	23.0	6.2	28.2

Upper Humboldt

	Depth of Snow in.	Dens. %	Water Equiv. in.	Percentage of March 1 Normal
Lamoille Falls	23.9	22.2	5.3	43.4
Precip. Lamoille Nov-Jan.			3.09	Percentage Nov- Feb. 49.4

Steptoe Valley

	Depth of Snow in.	Dens. %	Water Equiv. in.	Percentage of March 1 Normal
Murray Summit	12.6	21.4	2.7	

RESERVOIR STORAGE

As of January 1, 1944

	<u>Acre Feet</u>	
	January 1 Storage	Capacity
Humboldt Basin Upper & Lower Pitt-Taylor Reservoir	13,000	27,000
Rye Patch Reservoir	148,000	179,000
Truckee-Carson Lahontan Reservoir	206,000	290,000
Boca Reservoir	19,130	41,390
Walker River Bridgeport Reservoir	34,100	42,000
Topaz	34,300	59,000

Lake Tahoe January 1 elevation 6226.68

The capacity above that elevation to the maximum permissible elevation of 6229.10 is about 300,000 acre feet and from January 1 elevation down to the rim of the outlet--elevation 6223.00 is 453,000 acre feet, making a total of 753,000 acre feet from rim to maximum level.

Lake Mead	24,900,000	31,140,000
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A deficiency of snow cover seems to prevail at this time throughout the far West but there remain two months for further accumulation.

Bulletin issued by Nevada Cooperative Snow Survey, U. S. Soil Conservation Service, Division of Irrigation, and Nevada Agricultural Experiment Station.

H. P. Boardman and J. E. Church

February 5, 1944

Seasonal Snow Survey and Forecast of Stream Flow

April 1943

Nevada Co-operative Snow Surveys

PART I—CENTRAL SIERRA QUADRANGLE

Including the Truckee, Tahoe, Carson and East and West Walker Basins of the Eastern Slope

CO-OPERATION

The organizations co-operating this year in the surveys of this region are: The Nevada Co-operative Snow Surveys, including the State of Nevada, through the State Engineer's office, the Truckee-Carson Irrigation District, the Washoe County Water Conservation District and the Sierra Pacific Power Co.; the California Co-operative Snow Surveys headed by the Division of Water Resources of the Department of Public Works at Sacramento and including the Pacific Gas & Electric Co. and the Nevada Irrigation District, whose employees make the surveys of several of the courses used in this forecast; the U.S. Forest Service; and the Division of Irrigation of the U.S. Soil Conservation Service. This is the organization which is developing and co-ordinating the snow surveys throughout the western states. All of the above organizations contribute financially to the work.

The U.S. Weather Bureau and the Agricultural Experiment Station at the University of Nevada are also co-operating in various ways.

PART II. Humboldt Basin and Miscellaneous is prepared under the direction of Dr. J. E. Church of the Agricultural Experiment Station, University of Nevada.

REVIEW OF LAST YEAR

The runoff of the streams in this region for the 1942 season was very much greater than was expected, as is shown in the following table.

The reason was an unusually high April-May precipitation. U.S. Weather Bureau records for those two months show the following results: Truckee, Tahoe City and Marlette Lake had 345%, 186% and 208% of normal respectively; the average was 229% of normal for the following ten stations: Sierraville, Bowman Dam, Lake Spaulding, Blue Canyon, Soda Springs, Twin Lakes, Tamarack (Blue Lakes), Lake Eleanor, Hetch Hetchy and Gem Lake. Quantitatively the excess above normal ranged from 2.84" at Tahoe City and 2.80" at Gem Lake (which is 13 miles southeast of Tioga Pass, at altitude 9,000 ft.) to 11.66" at Blue Canyon and 12.64" at Lake Spaulding. This excess was 6.66" at Soda Springs and 8.42" at Tamarack (Blue Lakes). Most of the April excess fell on snow blanket in both high and low altitudes and the May excess on snow blanket in the high altitudes so that a large part of the April-May excess was directly effective in increasing the snow water content.

Approximate estimates give assurance that this excess spring precipitation was sufficient to easily account for the increase of runoff above that indicated by the April 1 snow surveys.

1942 RESULTS

BASIN OR STREAM	Normals	1942 Forecast		Actual Results	
		% of Normal	Amount	Amount	% of Normal
	Feet		Feet	Feet	
*Rise of Tahoe, April 1 to High Water.....	1.68	95.2	1.60	2.17	129.2
*Tahoe Maximum Elevation.....		July 15	6229.45	6230.02	July 26
Tahoe Maximum Controlled Elevation.....			6229.10	6229.01	July 14-15
	Acre Ft.		Acre Ft.	Acre Ft.	
Truckee River, Exclusive of Tahoe.....	325,700	87.5	285,000	341,300	104.8
Carson River at Ft. Churchill.....	230,000	66.1	152,000	252,800	109.9
West Walker Near Chris Flat.....	191,200	90.0	172,000	192,900	100.8
East Walker Below Bridgeport Dam.....	73,000	83.6	61,000	93,500	128.1

*Assuming gates kept closed; no outflow.

As shown in the above table the Tahoe outlet gates were so regulated as to keep the actual maximum elevation below the agreed upper limit and yet the difference, .09 ft., represented about 11,000 acre feet of lost storage. However, evaporation from the lake probably takes away nearly 400,000 acre feet annually.

OUTLOOK FOR 1943

Unusually heavy precipitation in the Central Sierra occurred in November, 1942, in the form of rain in most areas below 7500 altitude and snow in the higher altitudes. The percentage of normal ranged from 194% at Blue Canyon to 465% at Truckee and the actual excess above normal ranged from 3.80" at Tamarack (Blue Lakes) to 10.02" at Bowman Dam. A few other typical excess figures were: 8.37" at Sierraville; 8.19" at Soda Springs; 7.12" at Truckee; 5.61" at Tahoe City; 7.09" at Twin Lakes; and 8.44" at Lake Eleanor.

December precipitation was approximately 120% of normal. January was also high, ranging from 135% of normal at Tamarack to 239% at Marlette Lake, the average of 14 stations being 175% of normal. February was low in precipitation, most of the above group ranging from 40% to 80% of normal. March was 108% at Tahoe City and 127% at Soda Springs.

December-March temperatures were above normal at most of the U.S.W.B. stations of this region and with the good start resulting from the November rains, the winter runoff of the Truckee, Tahoe and Carson basins continued high for the whole period November-March.

The snow surveyors, during the winter and also about April 1 encountered more than usual difficulty from several layers of crust and frequently ice at the bottom. Low level snow measurements were in general much below normal in water content but many high level courses were considerably above normal.

More than usual drifting due to wind action was noticed in high altitudes.

Low level ground water conditions are good due to the heavy November and later rains in low altitudes, when snow fell higher up.

The prospects are good considering excellent storage conditions, though most of the basins are expected to yield somewhat less than normal runoff during the April-July period.

TRUCKEE RIVER

The winter runoff of the Truckee River exclusive of Tahoe and corrected for Little Truckee storage changes, was 187% of normal for the November March period, the lowest month in percentage of normal being February at 149%.

This heavy winter runoff has resulted in a rise of Pyramid Lake from a minimum of 3816.33 on November 20 to elevation 3820.84 on April 26, and more rise will continue before evaporation exceeds inflow.

The Little Truckee low level snow courses had a better water content in percent of normal this year than the Tahoe Basin low level courses but the Truckee higher courses and South Yuba were not so good as the Tahoe high courses.

The April-July natural runoff exclusive of Tahoe is estimated at 300,000 acre feet. The normal distribution would be as follows:

	%	Acre Ft.	Last Year %
April	32	96,000	32
May	38	114,000	31
June	23	69,000	29
July	7	21,000	8
Total	100	300,000	100

Boca Reservoir contained about 20,900 acre feet storage on April 1 and Independence Lake 11,200.

TAHOE

The November rains raised the lake from a minimum elevation of 6227.24 on November 14 to 6227.74 on November 30.

Small quantities were being drawn from the lake during late November, all of December and until January 22 after which the draft was increased due to rapid rise of the lake. The lake reached a maximum elevation of 6228.59 on January 25 only .51 ft. below the agreed upper limit. By the maintenance of a heavy draft the elevation was reduced to 6228.10 before the end of February and the maximum reached during March was 6228.32 on the 11th. On April 1 the elevation was 6228.20. It is estimated that if the gates were kept closed after April 1 the rise to high water in July would be 1.70 or to elevation 6229.9 so unless heavier spring precipitation than last year is experienced there should be no difficulty in controlling the elevation within pretty close limits.

CARSON RIVER

The winter runoff of the Carson River at Ft. Churchill was somewhat higher in proportion than the Truckee, being about 196% of normal for the November-March period. It is estimated that the April-July runoff will be about normal or 230,000 acre ft.

More than 100,000 acre feet were run through the Lahontan reservoir during the January-March period. The reservoir storage April 1 was 248,700 acre feet.

WALKER RIVER

The Walker Basin did not develop high winter runoff like the Truckee and Carson but was below normal through most of the winter.

Two snow courses, Center Mountain and Buckeye Forks, were not surveyed this season, making the forecasting somewhat more questionable than usual.

It is estimated that the West Walker runoff at Chris Flat will be about 174,000 acre feet for April-July and the East Walker at Bridgeport Dam about 60,000 acre feet for April-August.

On April 1 Topaz reservoir contained 59,450 acre feet storage and Bridgeport reservoir 42,900 acre feet.

1943 PROGRESS SNOW SURVEYS DURING THE WINTER

Basin	Snow Course	Altitude	1943 Date Survey	Depth Snow Inches	Density % Water	Water Content Inches	April 1 Normal Water Content Inches	% April 1 Normal 1943	Year 1942	
									% April 1 Normal	Date
Crest and South Yuba	Furnace Flat	6600	2/3 3/2	101.2 101.2	31.4 40.8	31.8 41.3	(59) (59)	53.9 70.0	76.3 75.4	2/10 3/3
	Fordyce Lake	6500	2/3 3/3	84.6 80.8	33.8 43.1	28.6 34.8	(51) (51)	56.1 68.2	72.2 78.0	2/9 3/3
	Soda Springs	6750	2/2 3/1	90.5 77.7	33.1 41.8	30.0 32.5	(42) (42)	71.4 77.4	59.0 91.7	1/30 2/27
	Summit	6900	2/2 3/1	89.0 82.6	33.8 43.3	30.1 35.8	47.8 47.8	63.0 74.9	55.0 84.9	1/30 2/27
	Ward Creek	7000	2/6 2/28	98.7 102.8	34.1 39.5	33.7 40.6	52.7 52.7	63.9 77.0	60.7 86.9	2/1 3/1
Truckee Basin	Independence Camp	7000	2/6	61.9	31.8	19.7	(26.5)	74.3	57.7	2/2
	Independence Creek	6500	2/6	33.4	33.2	11.1	(18)	61.7	51.7	2/2
	Sage Hen Creek	6500	2/7 2/28	53.3 52.5	31.0 37.9	16.5 19.9	(22) (22)	75.0 90.5	55.0 93.6	1/31 2/28
	Boca	5900	1/31 2/27	16.9 15.4	21.3 37.0	3.6 5.7	(9) (9)	40.0 63.3	55.6 98.9	1/31 2/28
	Truckee No. 2	6400	1/31 2/27	44.4 44.7	28.8 33.8	12.8 15.1	(20) (20)	64.0 75.5	59.0 92.5	1/31 2/28
Tahoe Basin	Tahoe City	6250	2/1 3/1	28.2 24.6	26.6 37.0	7.5 9.1	15.9 15.9	47.2 57.2	57.9 85.5	1/31 2/23
	Ward Creek	7000	2/6 2/28	98.7 102.8	34.1 39.5	33.7 40.6	51.2 51.2	65.8 79.3	62.5 89.5	2/1 3/1
	Marlette Lake	8000	3/5	76.1	37.0	28.2	27.8	101.4	106.1	3/3
	Glenbrook No. 2	6900	1/29 2/28	36.2 50.8	27.1 28.3	9.8 14.4				
	Daggett's Pass	7350	1/29 2/28	32.9 35.8	25.5 32.1	8.4 11.5	16.3 16.3	51.5 70.6	81.0 101.2	1/31 3/1
	Hagan's Meadows	8000	2/3 3/1	54.0 51.1	29.1 34.2	15.7 17.5	21.2 21.2	74.1 82.5		
	Freel Bench	7300	2/3 3/1	28.5 25.6	29.8 34.8	8.5 8.9	(15) (15)	56.7 59.3	80.7 113.3	2/1 2/28
	Upper Truckee	6400	1/30 3/1	25.7 15.3	17.9 34.0	4.6 5.2	(11) (11)	41.8 47.3	83.6 123.6	2/1 2/28
	Richardson's	6500	1/30 3/2	31.1 24.7	20.3 28.3	6.3 7.0	(13) (13)	48.5 53.8	69.2 90.0	1/31 2/28
	Echo Summit	7500	1/27 3/2	99.0 98.6	31.4 39.4	31.1 38.8	(40) (40)	77.8 97.0	72.3 107.5	1/28 2/26
	Lake Lucille	8400	2/1 3/3	151.4 157.5	34.5 40.8	52.2 64.3	61.2 61.2	85.3 105.1		
Carson Basin	Carson Pass	8600	2/1 3/1	96.8 107.9	31.4 38.1	30.4 41.1	(48) (48)	63.3 85.6	59.4 77.5	1/29 2/26
	Blue Lakes	8000	1/31 2/28	110.2 113.0	29.5 32.7	32.5 37.0	48.1 48.1	67.6 76.9	60.9 83.8	1/31 2/28
Mono	Tioga Pass	9900	2/24	69.7	42.0	29.3	(31)	94.5	100.0	2/24

APRIL 1, 1943, SNOW SURVEY DATA

SNOW SURVEY STATIONS	Eleva- tion Feet	Date of 1943 Snow Survey	Depth of Snow Inches	Density of Snow % Water	Water Equiva- lent April 1 Inches	Normal Water Equiva- lent April 1 Inches	1943 Sea- sonal % of Normal	Last Year % of Normal
TRUCKEE BASIN								
Crest and South Yuba								
Furnace Flat.....	6600	March 30	105.0	43.6	45.8	(59)	77.6	81.5
Fordyce Lake.....	6500	March 31	82.5	48.2	39.8	(51)	78.0	80.0
Soda Springs.....	6750	April 2	81.8	48.3	39.5	(42)	94.0	90.7
Donner Summit.....	6900	April 2	81.6	50.4	41.1	47.8	86.0	87.2
Ward Creek.....	7000	March 28	108.9	47.6	51.8	52.7	98.3	92.6
Little Truckee								
Webber Peak.....	8000	March 25	108.4	45.4	49.2	56.9	86.5	94.9
Webber Lake.....	7000	March 27	90.0	45.1	40.6	38.1	106.6	85.3
Independence Lake.....	8400	March 28	120.6	41.8	50.4	(47)	107.2	90.2
Independence Camp.....	7000	March 27	57.3	42.1	24.1	(26.5)	90.9	89.8
Independence Creek.....	6300	March 27	32.2	43.5	14.0	(18)	77.8	82.2
Sage Hen Creek.....	6500	March 29	45.0	42.9	19.3	(22)	87.7	93.2
Eastern Outposts								
Granite Peak.....	8200	March 28	73.4	38.1	28.0	24.7	113.4	87.0
Big Meadow.....	8800	April 4	81.5	46.9	38.2	28.1	135.9	84.7
Mt. Rose.....	9000 to 10,000	March 28	103.9	43.2	44.9	(45)	99.8	84.2
Lower Levels								
Boca No. 2.....	5900	March 27	Course	Practically Bare		(9)	0	71.1
Truckee No. 2.....	6400	March 27	36.6	36.6	13.4	(20)	67.0	89.5
Tahoe City.....	6250	April 1	18.0	48.3	8.7	15.9	54.7	78.0
TAHOE BASIN								
Crest Main Sierra								
Ward Creek.....	7000	March 28	108.9	47.6	51.8	51.2	101.2	95.3
Rubicon Peak No. 1.....	8100	April 4	136.4	41.3	56.4	48.9	115.3	98.2
Rubicon Peak No. 2.....	7500	April 4	84.6	44.4	37.6	(36)	104.4	102.5
Lake Lucile.....	8400	March 28	171.0	44.7	76.5	61.2	125.0	97.1
Echo Summit.....	7500	April 1	102.7	46.7	48.0	(40)	120.0	110.0
Eastern Outposts	9000 to							
Mt. Rose.....	10,000	March 28	103.9	43.2	44.9	(45)	99.8	84.2
Marlette Lake.....	8000	April 1	78.8	43.4	34.2	27.8	123.0	108.6
Hagan's Meadow.....	8000	March 30	54.4	34.7	18.9	21.2	89.2	100.9
Lower Levels								
Tahoe City.....	6250	April 1	18.0	48.3	8.7	15.9	54.7	78.0
Rubicon Peak No. 3.....	6700	April 4	47.1	46.1	21.7	(30)	72.3	85.3
Richardson's.....	6500	March 31	17.3	36.4	6.3	(13)	48.5	90.8
Upper Truckee.....	6400	March 30	9.7	23.7	2.3	(11)	20.9	90.0
Freel Bench.....	7300	March 30	23.7	39.2	9.3	(15)	62.0	100.0
Daggett's Pass.....	7350	March 27	34.1	37.5	12.8	16.3	78.5	100.6
Glenbrook No. 2.....	6900	March 29	49.4	33.6	16.6	(20)	83.0	86.5
WASHOE VALLEY								
Marlette Lake.....	8000	April 1	78.8	43.4	34.2	27.8	123.0	108.6
Little Valley.....	6300	March 27	22.7	49.8	11.3			
CARSON BASIN								
Crest West Carson								
Carson Pass.....	8600	March 28	112.8	45.2	51.0	(48)	106.2	86.7
Blue Lakes.....	8000	March 31	115.4	40.1	46.3	48.1	96.3	83.2
East Carson								
Poison Flat.....	7900	April 1	45.7	41.6	19.0	(18)	105.6	86.1
WALKER BASIN								
West Walker								
Sonora Pass.....	8800	March 27	76.9	39.0	30.0	(31)	96.8	82.9
Leavitt Meadow.....	7200	March 26	17.0	48.2	8.2	(16)	51.2	83.1
Willow Flat.....	8250	March 29	39.1	39.6	15.5	17.5	88.6	82.8
East Walker								
Center Mountain.....	9400	Not Surveyed This Year				45.7		97.4
Buckeye Forks.....	8500	Not Surveyed This Year				26.0		88.1
Buckeye Roughs.....	7900	March 30	47.4	39.7	18.8	25.9	72.6	91.1
Dunderberg Peak.....	8400	March 31	86.7	42.6	36.9	(45)	82.0	60.7
MONO BASIN								
Crest								
Tioga Pass.....	9900	April 1	93.6	38.1	35.7	(31)	115.2	116.1

() Tentative Normals

FORECAST CENTRAL SIERRA — EASTERN SLOPE
APRIL-JULY, 1943

BASIN OR STREAM	Normals	Seasonal Forecast			
		Probable		*Possible Minimum	
		% of Normal	Amount	% of Normal	Amount
	Feet		Feet		Feet
†Rise of Tahoe, April 1 to High Water.....	1.68	101.2	1.70	92.3	1.55
Tahoe, Maximum Controlled Elevation.....	July 10		6229.1		6229.0
	Acre Feet		Acre Feet		Acre Feet
§Truckee, Exclusive of Tahoe.....	325,700	92.1	300,000	82.9	270,000
Marlette Lake.....		120			
Carson at Ft. Churchill.....	230,000	100	230,000	91.3	210,000
West Walker Near Chris Flat.....	191,200	91.0	174,000	83.7	160,000
‡East Walker Near Bridgeport Dam.....	73,000	82.2	60,000	74.0	54,000

* These, or even lower runoffs, may result from abnormally low spring temperatures or deficient precipitation.

† Assuming outlet gates kept closed; no outflow.

§ Including changes in Little Truckee Reservoir Storage.

‡ The forecast period for the East Walker is April-August because of late melting of snow in high altitudes and northeastern slopes of the Saw Tooth Range west of Bridgeport.

Distribution of April-July Runoff in Typical Streams—
Per Cent of Total April-July Runoff

	Truckee at Iceland Excl. of Tahoe	Carson at Clifton	West Walker at Coleville
April	32	19	11
May	38	36	29
June	23	34	37
July	7	11	23
April-July	100.0	100.0	100.0

A retardation in the earlier months of the series assures an increase in the later months and vice versa.

Table A, below, shows what Lake Tahoe is able to supply at various elevations with gates wide open. Table B, below, shows the need of drawing from the lake during the summer and fall to maintain a flow of 500 cubic feet per second at Iceland.

A. Draft Possible at Various Elevations

Elev. (Ft.)	Draft (C.F.S.)	Elev. (Ft.)	Draft (C.F.S.)
6223.0	0	6225.5	520
6223.5	24	6226.0	730
6224.0	88	6227.0	1160
6224.5	183	6228.0	1600
6225.0	325	6229.0	2060

One foot depth on Tahoe is equivalent to 123,300 acre feet.

**B. Natural Flow of Truckee River at Farad, Exclusive of
Tahoe (Much Affected by Rains) August-October**

	Normal Acre Feet	Second Feet
August	7485	122
September	5800	98
October	6545	106

WINTER PRECIPITATION

*Typical Progress through winter for
Central Sierra Region:

Dec.-March		Nov.-March	
Date	% Due	Date	% Due
Dec. 1	0	Dec. 1	12
Jan. 1	21	Jan. 1	31
Feb. 1	50	Feb. 1	57
Mar. 1	76	Mar. 1	79
Apr. 1	100	Apr. 1	100

†Seasonal Progress
Tahoe City Precipitation, Nov.-March,
1942-1943:

Date	% of Seasonal	Actual Inches	% of Normal Due
Dec. 1	29	8.53	292
Jan. 1	47	13.74	184
Feb. 1	84	24.81	182
Mar. 1	92	27.13	137
Apr. 1	100	29.53	119

* Based on U.S.W.B. Revised Normals, %
Due being averages for nine U.S.W.B.
Stations in Central Sierra.

† Percent of Normal Due based on U.S.W.B.
Revised Normals for Tahoe City.

Nov.-March normal.....	24.81
Dec.-March normal.....	21.89

Reno, Nevada, April 27, 1943.

ASK FOR MORE COPIES IF NEEDED

GEO. G. DEVORE,
LEIGH SANFORD,
H. P. BOARDMAN, Chairman,

Forecast Committee
Nevada Co-operative Snow Surveys.